63-3-3

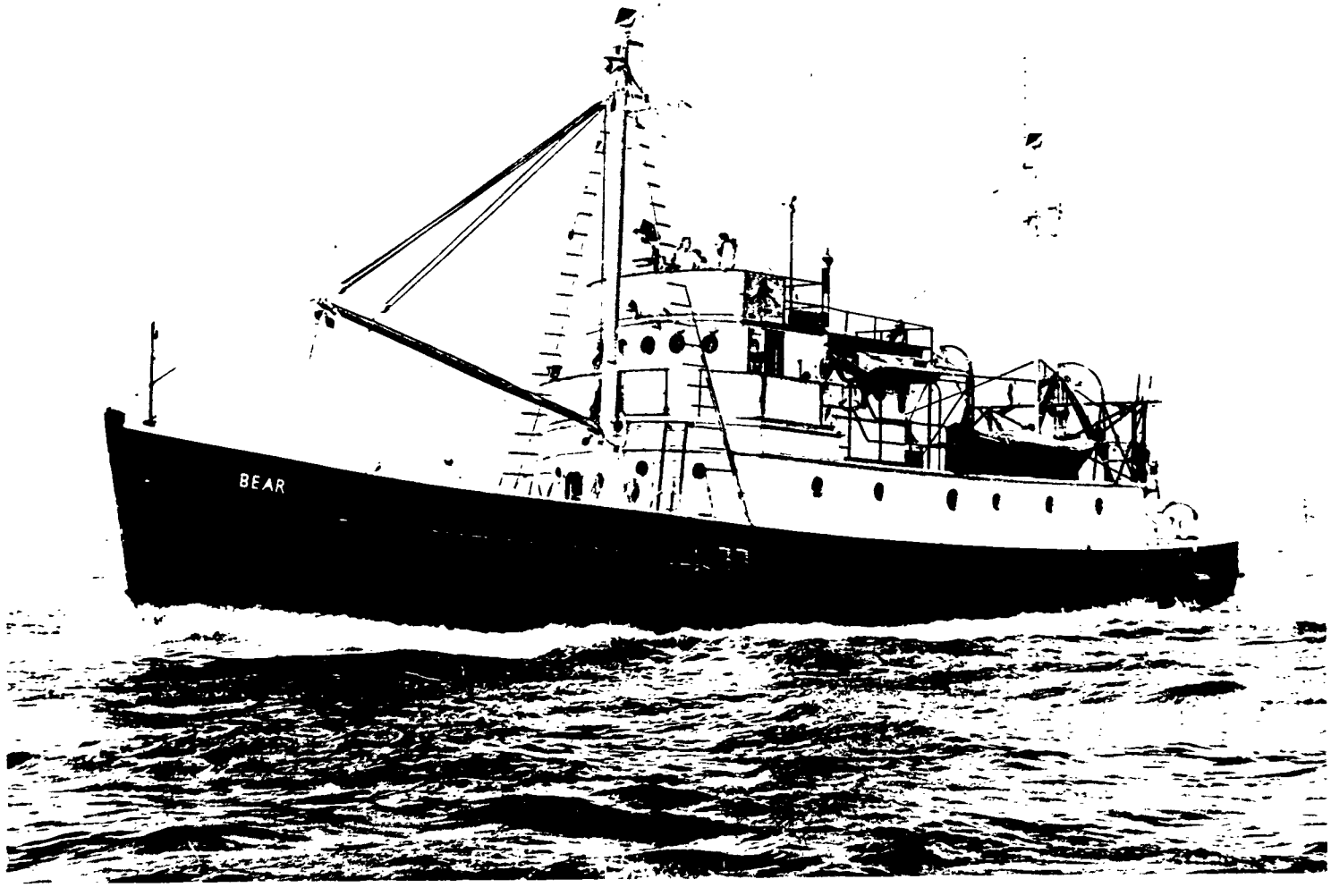
WOODS HOLE OCEANOGRAPHIC INSTITUTION

Reference No. 63-10

Narrative of BEAR Cruise #280

July 1962

WOODS HOLE, MASSACHUSETTS


BEAR

WOODS HOLE OCEANOGRAPHIC INSTITUTION
Woods Hole, Massachusetts

Reference No. 63-10

Narrative of BEAR Cruise #280

July 1962

by

Elizabeth T. Bunce

March 1963

Submitted to the Office of Naval Research, under Contracts Nonr-2196(00) and 4029(00) (formerly 1367(00))

APPROVED FOR DISTRIBUTION J. B. Hersey RHB

J. B. Hersey, Chairman
Department of Geophysics

TABLE OF CONTENTS

ABSTRACT

This is a journal of BEAR Cruise 280. It contains the track chart and a summary of the data taken on the cruise. Most of the time was spent about 150 miles southeast of Cape Hatteras during a cooperative seismic refraction program which included R. V. CRAWFORD, as well as shore stations occupied by the University of Wisconsin. The scientific program of the BEAR included an echo-sounding survey, scattering layer observations, and seismic refraction studies.

INTRODUCTION

Between 10 and 30 July, 1962, Research Vessels BEAR and CRAWFORD participated in a program of seismic refraction studies in the region southeast of Onslow Bay, North Carolina. CRAWFORD had on board a scientific party from Lamont Geological Observatory under John Ewing and, later, Clyde Buchanan. The refraction studies extended from approximately 70 km inland out across the continental shelf and slope almost 300 km. The seismic observations on land were made by the University of Wisconsin. The shots were fired by a Naval Demolition Team aboard USCGS CHILULA. The objectives of the cruise are described in WHOI Technical Memorandum #2-62, Cruise Plan for BEAR 280. (Appendix A of this report.)

Echo-soundings and scattering layer observations were made during the passage from Woods Hole to the area south of Onslow Bay. A brief, intensive bathymetric survey was made of the region lying between 31° and 32° N and 74°-75° W; i. e. in the northern section of the outer ridge escarpment.

Figure I is a chart of the cruise. Table I summarizes the data taken. The journal was prepared by the Chief Scientist, Elizabeth T. Bunce.

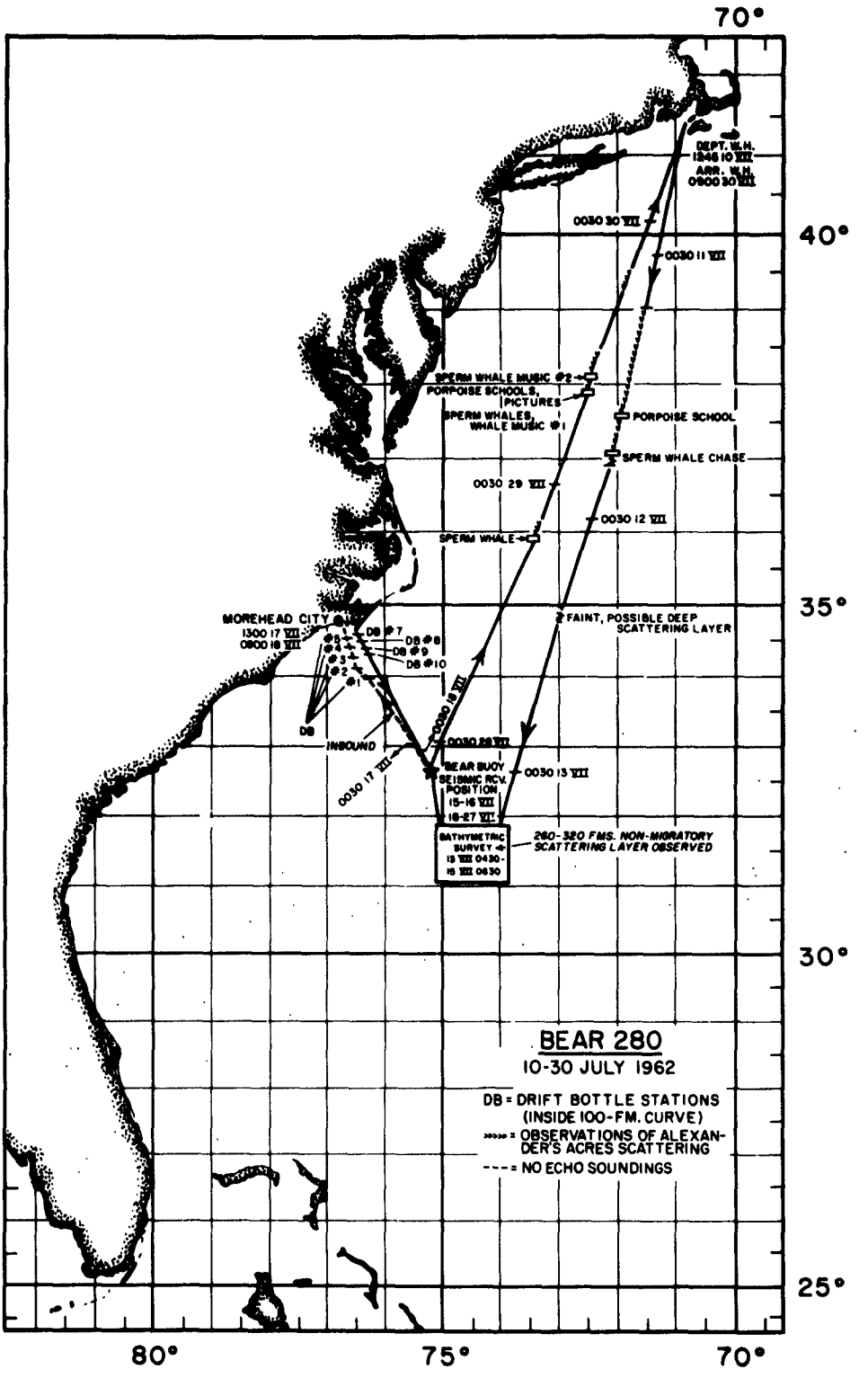

70°
40°
35°
30°
25°
80°
75°
70°
DEPT. W.H. 1346 10 VII
ARR. W.H. 0900 30 VII
0030 30 VII
0030 11 VII
SPERM WHALE MUSIC #2
PORPOISE SCHOOLS, PICTURES
SPERM WHALES, WHALE MUSIC #1
PORPOISE SCHOOL
SPERM WHALE CHASE
0030 29 VII
0030 12 VII
SPERM WHALE
MOREHEAD CITY
1300 17 VII
0900 18 VII
DB #7
DB #8
DB #9
DB #10
#5
#4
#3
#2
#1
DB
INBOUND
0030 18 VII
0030 28 VII
0030 17 VII
BEAR BUOY
0030 13 VII
SEISMIC RCV. POSITION 15-16 VII 18-27 VII
BATHYMETRIC SURVEY 13 VII 0430 - 16 VII 0630
280-320 FMS. NON-MIGRATORY SCATTERING LAYER OBSERVED
2 FAINT, POSSIBLE DEEP SCATTERING LAYER
BEAR 280
10-30 JULY 1962
DB = DRIFT BOTTLE STATIONS (INSIDE 100-FM. CURVE)
>>>> = OBSERVATIONS OF ALEXANDER'S ACRES SCATTERING
--- = NO ECHO SOUNDINGS

Fig. 1

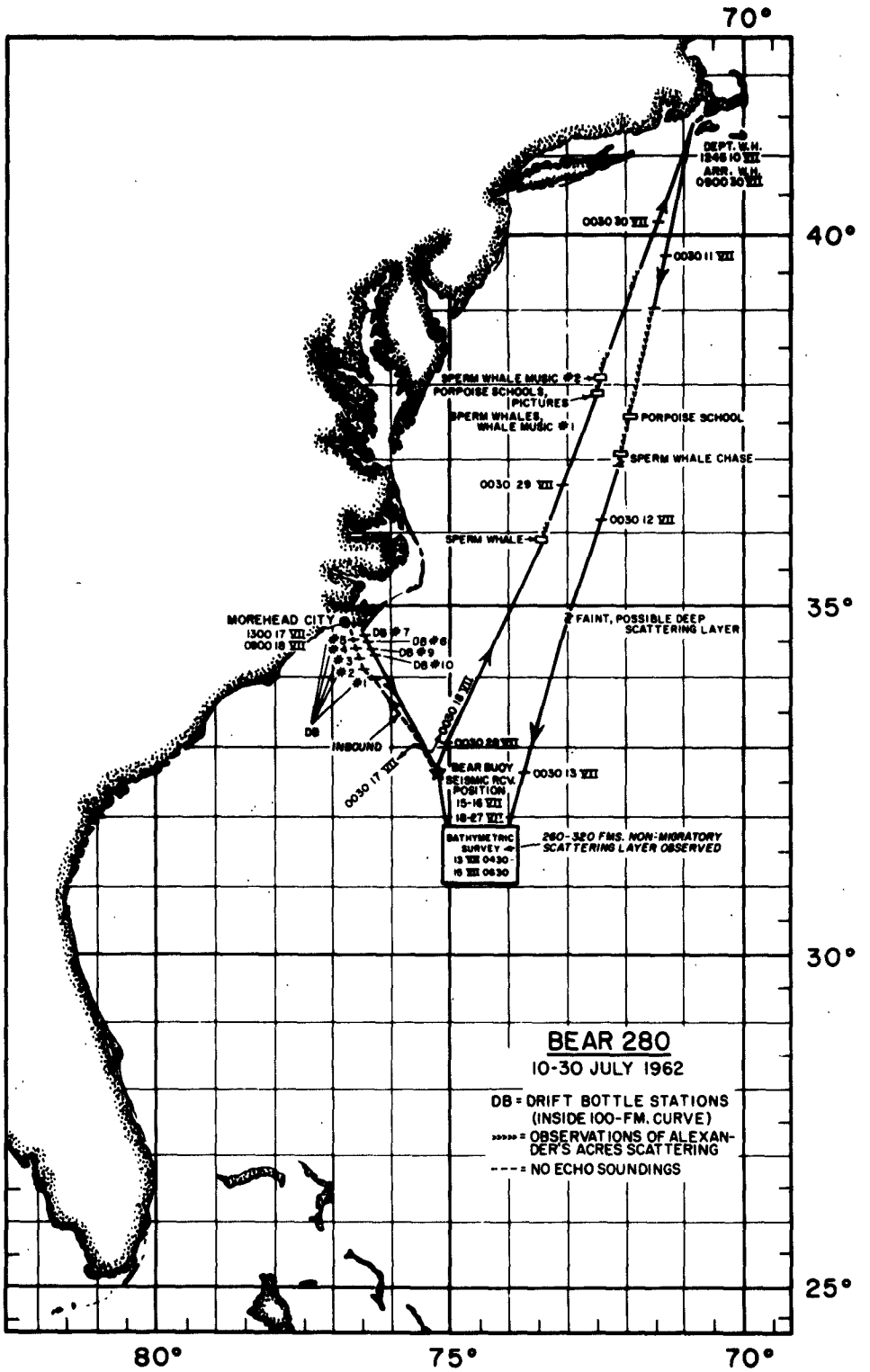

70°
40°
35°
30°
25°
80°
75°
70°
DEPT. W.H. 1346 10 VII
ARR. W.H. 0900 30 VII
0030 30 VII
0030 11 VII
SPERM WHALE MUSIC #2
PORPOISE SCHOOLS, PICTURES
SPERM WHALES, WHALE MUSIC #1
PORPOISE SCHOOL
SPERM WHALE CHASE
0030 29 VII
0030 12 VII
SPERM WHALE
MOREHEAD CITY
1300 17 VII
0900 18 VII
DB #1
DB #2
DB #3
DB #4
DB #5
DB #6
DB #7
DB #9
DB #10
DB
INBOUND
0030 18 VII
0030 28 VII
0030 17 VII
0030 13 VII
BEAR BUOY
SEISMIC RCV. POSITION
15-16 VII
16-17 VII
BATHYMETRIC SURVEY
13 VII 0430 - 16 VII 0630
FAINT, POSSIBLE DEEP SCATTERING LAYER
260-320 FMS. NON-MIGRATORY SCATTERING LAYER OBSERVED
BEAR 280
10-30 JULY 1962
DB = DRIFT BOTTLE STATIONS (INSIDE 100-FM. CURVE)
>>>> = OBSERVATIONS OF ALEXANDER'S ACRES SCATTERING
- - - = NO ECHO SOUNDINGS

Fig. 1

BEAR #280 CRUISE JOURNAL

10 July 1962

We departed Woods Hole at 1245, having been delayed one day by a combination of inclement weather and electronic problems. Scientific party aboard; Elizabeth Bunce (Chief Scientist), John Clough, James Doutt, Donald Krotser, Lewis Shapiro.

The echo-sounding fish transducer was put over at the harbor buoy and both EDO's were checked out with the PGR; we put #1 on standby, operating on #2; after a few minor mistakes in operating technique all is working well. At Tarpaulin Cove had a radio check with Fritz Hess on CRAWFORD (in Woods Hole) to tune SSB receivers. Set up rotating watches for this first part of the trip, each person on four hours, Chief Scientist on standby. We will use two-channel two-helix operation on the PGR, using one for scattering layer, the other for bathymetry while in good scattering layer country.

The crew has a trolling line astern and will maintain fish log if any are caught or observed.

11 July 1962

0530 - observed start of Alexander's Acres type scattering layer. The records are moderately noisy at full speed, an additional factor being the wind and a quartering sea on the port. (Fish is towing just abaft the port beam, depth about 18' at full speed.) Weather gradually becoming clear and very pleasant; a few petrels accompanying us; some bits of sargassum observed. Made check of ship speed vs fish noise during the AM. It may be necessary to slow down for good recording resolution; we already plan to make the bathymetric survey at no more than 2/3 speed.

1145 - the destroyer ROBERTS, DD 832, passed us close to starboard, obviously wondering what the Plywood Palace was up to out in the deep ocean. Several other DDs off on the horizon.

1155 - more Alexander's Acres observed on PGR recordings; slowed to standard speed for a short time in order to obtain better recordings.

1626 - whale sighted, fluked; we noticed other spouts in the same region. Underway on whale chase. We tentatively identified these as sperm whales (this was verified by Schevill upon our return and his seeing our pictures); there were two groups each of 5 - 6 whales; the individuals 15 - 20' long, tan-gray, showing a single, almost vestigial dorsal fin set well towards the tail, blunt square head, blowhole well forward (top of nose) and they blow forward; the flukes resemble that of right whale but smaller. We should have some excellent pictures. Since the tape recorders are not yet ready, nor is there a cable and hydrophone rigged for quick use we decided not to try tape recording, but hope to see more of the same critter later in the trip when we are better organized. Saw another pod ? later in the evening. Also during the evening, radio contact with CRAWFORD. John Clough and I attempting to help with their Alden recorder problems (mechanical). Need closed circuit TV to appreciate the arm waving and gesticulating on our ship.

12 July 1962

Crossed Gulf Stream during the night. Weather now excellent. Very faint deep scattering layer only apparent when we hove-to to pick up some floats spotted by the Bridge. Small number of porpoise seen in early AM. A few petrels around and about two flying fish spotted, otherwise no obvious marine life. Patches of weed are very sparse and small. Rigged forward hydrophone and cable this AM. Checked out suitcases, AC and DC power supplies. Checked tape recorders, Crown and Mnemotron. We have been maintaining a record of Timesfax and Nardin (break-circuit chronometer) vs WWV for rating. The Nardin gains and gains. The Timesfax shows almost no drift. (Using the battery converter on it to avoid stoppages due to generator shifts, etc.). At 1600 the ship stopped for minor engine repair. We seized the opportunity to go on silent ship and check out all our receiving gear. Found a number of electronic problems in suitcases and AC supplies, some of which we will fix, some will wait until we get home. One of the three suitcase AC supplies has 60 cps ripple way above useable limit, and we have not adequate spares to cope with it. Two others could be used if absolutely necessary and if

suitcase gain is down 40 db at least. This indicates use of the DC supplies if we cannot reduce the 60 cps ripple. One suitcase calibration circuit is inoperative. Turn to putting floats on second cable, also while stopped. A large freighter appears to westward, closing us rapidly, and has to alter course to pass - with all of the ocean to pick! (She was the GRAY MASTER of Oslo.)

During the late afternoon we picked up a white plastic float covered with assorted marine life. Dave Metzler (seaman) preserved some of the specimens in the collection kit.

13 July 1962

At 0530 we arrived in region of 32° N, 74° W where we started a bathymetric survey of the east slope of this section of the Outer Ridge. Slowed ship to 2/3 speed and commenced a series of crossings of the slope normal to the charted contours. All of this section of the echo-sounding data is being tape recorded (Crown) for later analysis. The bottom, so far, is not very interesting, the section south along 74° W shows no signs of sub-bottom layering; westward crossing of the slope shows smooth upward rise from 2600 to 1700 fms., we turn south and find gradual shallowing to 1600 fms., then back to east down continued smooth slope.

Between 1815 and 1845 we were subject of very careful scrutiny by a Navy plane (P2V) which made three passes at and around us. (Pilot wore red shirt). Note: - presence of scattering layer and sunset migration today.

14 July 1962

At 0030 we are in the deeper water at the base of the slope and looking for any signs of sub-bottom layering. There are none apparent. Proceeded south and then started second westward crossing of slope at 0200. The water did not get any deeper than 2600 fms. on the eastbound leg - there is a broader area of this depth water than our present chart indicates. No signs of surface scattering layer this morning, although there is a deep layer, non-migratory, at 260-320 fms. throughout most of this region.

We started rigging the anchored buoy on the forward deck. Thirty feet of pipe plus cross pieces for radar reflectors makes quite a space problem. The battery arrangement for the flasher is not going to be satisfactory for a long period - in fact, it is poor.

I have been thinking about the time left before we are due in the seismic area. We will make one more run as far to the east as we can in the remaining time to try for deeper water and to measure extent of this broad platform, then leave enough time to run west and tie all the western legs by crossing them with northward track to the shoot area.

Weather very hot - water temperature (surface) about 81°.

15 July 1962

At 0700 altered course to north and increased ship speed. So much ship noise on full speed that we had to reduce to standard in order to see the bottom on the PGR records. Clough and I worked on the buoy most of the day. At 1720 we are on station and ready to drop buoy. At 1800 buoy over - a beautiful drop, but horizontal and we cannot persuade it to come upright. It takes some major muscling to bring it back aboard - thirty feet of pipe with 100 pounds of weight at its base. All of us worked on alterations to the rig until early morning, then secured until daylight and breakfast before attempting another launch.

16 July 1962

According to our schedule, the seismic shoot begins tonight. At 0910 the buoy is ready to go over the side. I have moved the flotation up 8 feet and added 100 pounds of weight at the bottom. At 0920 - we start putting buoy in water, (depth of water 2080 fms). At 1004, the anchor is over at the end of 4010 meters of line. We are steaming slowly in the area waiting for the anchor to sink. Jim Doutt spotts the anchor going down on PGR, but cannot follow it all the way. While waiting, back to work on re-check of all receiving gear. Hydrophone cable #5 appears intermittent and we have considerable 60 cps hum in both bow and stern hydrophones; upon switching to battery stack (DC) operation throughout, everything is beautiful. Loran fixes and water depth indicate the buoy is anchored by 1130, so we go on silent ship, and fire a couple of caps to check the receiving system, hydrophones through the HTL to the camera. All appears well.

We have had radio contact with CRAWFORD earlier in the day via our SSB. (BEAR bridge transmitter is inoperative although receiver is okay.) John Ewing (Chief Scientist - CRAWFORD) suggested that we try recording their reflection shots as they close our position this evening. At about 1900, while checking out our systems and practicing cable slacks, I realized that I had been hearing shots via the hydrophones. We timed the next few to determine shot intervals, then slacked our cables, and record. This is an elegant way to obtain the necessary information as to hydrophone quieting and amplifier operation, to say nothing of training the slackers, even though the shots are half-pound blocks at better than 10 miles.

Contact with CRAWFORD at 2000. They are going directly to their listening position and start to put their buoy over. Meanwhile, it has become obvious that our sick seaman (a new crew man who has been seasick almost since leaving Woods Hole) should be taken ashore to a doctor. Now that CRAWFORD is in position to take the seismic shots we will run for Morehead City and a doctor and also pick up water and supplies for the rest of the trip. At 2200 we make full speed for Morehead City. CRAWFORD will attempt to tell the CHILULA that we are off station if she can make contact. We have had no luck with radio contacts except with CRAWFORD.

17 July 1962

Tied up at the Marine Terminal, Morehead City, at 1300.

[redacted] enroute into port this morning we acted as radio link between [redacted] CRAWFORD. I also made first contact with CHILULA and ared up some operating problems, including that of a firm [redacted]le for days when shooting is not taking place. The shot [redacted] set up for nights only due to excessive land noise during the days making reliable receiving impossible. Tonight to start at 1130, 5 shots at two-hour intervals, all inshore in water of less than 100 fms depth. Next shots start 0200, Thursday (today is Tuesday). We will be on station in time for the Thursday shoots.

We made six drift bottle stations for Bumpus between the 100-fathom curve and the harbor buoy.

18 July 1962

We had to wait until the morning to fuel but were underway by 1000. E/S fish in water at entrance buoy. CHILULA is hove-to just out of the channel, as we depart. We passed astern of her, called on radio, and did everything but throw rocks to attract the attention of the scientific party aboard. No reaction.

During early afternoon the PGR blade drive failed and was replaced with a spare.

Made our radio contact with CHILULA later in the day; shots are scheduled at one-hour intervals starting at 0200, all 2000 pounds, at every second shot point between 100 and 500 fathom curves. They informed us that only four shots were fired this AM, lack of radio communications forced cancelling the fifth. So, we have missed only four shots, and these are very shallow. (Nighttime atmospherics being what they are, this will be a continuing problem, I'll bet.)

Microswitch trouble on PGR channel 1. John Clough fixed it. One Loran died just outside Morehead City so we will DR back to buoy and station. Drift bottle stations 7 through 10 outbound. On station about midnight after some interesting search patterns while hunting the buoy - which is apparently right where we left it according to depth and the poor Loran we now have.

19 July 1962

Shots scheduled to start at 0200. We could make no radio contact with CHILULA before the shots so neither CRAWFORD nor BEAR recorded the first shot of this set. Managed to record following shots although radio communications leave much to be desired. Prior to the 0400 shot, a heavy rain squall and also a wind shift just before slacking. The bow hydrophone carried under the ship and wrapped around E/S fish cable as the ship swung; we had an interesting ten minutes while we unsnarled the resultant tangle. CHILULA is having trouble with the coded firing and shot instant signals.

During the day we arranged a meeting with CRAWFORD (they want the cigarettes we brought out for them). They came alongside at 1300. I went aboard CRAWFORD for confab on work so far and how we can improve and add to it. The results of the few big shots so far are discouraging, on both our recordings. We, therefore, decided to shoot a short small-charge profile between the two ships to make sure that all is as it should be; i. e.: - that it is still possible to get good refraction arrivals in deep water! Transferred one box of 1/2# blocks to BEAR, and ten reels of sound recording tape to CRAWFORD. J. Ewing returned to BEAR with me and we did some hydrophone and cable work, sensitivity testing, slacking tests, etc. The weather being very calm and clear and it being movie night on CRAWFORD, half the BEAR crew attended the first show during this time. The other half of the crew attended second show while we steamed off and John Ewing did some shooting for CRAWFORD to receive. CRAWFORD reports good refraction arrivals, everything looking normal. We returned to CRAWFORD position and retrieved movie goers; J. Ewing also returned to CRAWFORD, and they steamed for their buoy, shooting to us, out to a range of 18 seconds. Good results and quite encouraging.

20 July 1962

We took six big shots, all deep, between 0200 and 0600. Some trouble slacking since sea and wind are so near zero that we cannot get hydrophones away from the ship. The results, of course, are very quiet traces.

The weather is extremely hot and muggy so the first mate allows science swim call after the last shot. This turns out to be the last swimming of the trip since the first shark is seen later in the morning. At about 0700 a large ship is seen on horizon making clouds of black smoke. As it closes us, it is identified as a large aircraft carrier putting off morning flights. It comes within less than a half mile and all of us still awake are clicking cameras like mad. Turns out to be the U. S. S. CONSTELLATION.

The sea is glassy calm. Five porpoises are playing around our buoy. There is more marine life visible today than during the entire trip so far. Large quantities of Sargassum, porpoises, sharks, and finally a school of tuna. Some kind of small noises on hydrophones are reminiscent of the trigger fish nibbling during the shooting on the Outer Ridge. No marks are observed on the boot when hydrophone is pulled in, however.

At 1300 CRAWFORD is alongside again. We have been working with Boomer during morning, so they put over a hydrophone and listened. Another consultation with CRAWFORD group about the big shots received so far, and the results, indicate that we should try placing one ship closer inshore on shelf. Neither of us is getting good refraction arrivals. Since CRAWFORD must go in for supplies anyway, she is the logical choice. We will accompany them part way, with Boomer, and they will tow a new hydrophone array (Eel). The results are interesting and warrant further investigation between shot schedules when they return from port. This Boomer operation is secured at 1950, we are returning to our buoy, CRAWFORD steaming for new position in 500-fathom water (at about 33°30' N - 74°10' W). They will attempt to set another buoy there, but since this is close to axis of the stream it may not be too successful. Another shark (white tip) is sighted during the evening.

2200 - at buoy. The last Loran set is now acting up badly. Light has gone out on the buoy; we are working on a replacement to put on in the morning.

21 July 1962

Received shots from 0200 to 0600. Camera power failed on first two but they are recorded on tape. Found camera failure due to a broken lead in the connecting cable. Best radio communications during shooting that we have had so far. CRAWFORD reports excellent refraction arrivals - worthwhile moving in shore.

By the time of the last shot, the weather had changed for the worse; wind and sea are making up, overcast. Skipper says not to attempt putting new light on buoy - too rough. BT trace shows change in water structure since yesterday which combined with increased marine life observed makes us speculate that the Gulf Stream may have swung out here. Wind has increased to 20 to 25 knots with gusts up to 40 knots. We will regret not getting the light on that buoy, with the Loran receivers acting badly, if we steam off to work away from here, and while holding station during shots. I decided to let the scientific party get some sleep during the day, while we are jogging up and down-wind in buoy area. All gear checked and relashed where necessary. Some wind gusts up to 50 knots during early evening. No shots - CHILULA has gone in for powder.

22 July 1962

Lost sight of buoy about 0200. Too much sea return for radar. But, it is found again by Captain at 1000. State 6 seas, wind gusts up to 50, average around 30 knots. No luck on seismic profiling. Catching up on various equipment malfunctions and testing ideas that we have not had time for previously. Altec (PGR) quit. Overheating. Ok once it is allowed to cool. Ship rolling moderately.

23 July 1962

This no-work weather is trying on the nerves. Can keep only one or two people busy on assorted electronic tasks, the others are catching up on sleep. Shots scheduled tonight. The sea is still rough enough so we may have noise problems with hydrophones.

Radio contact with CRAWFORD during the day. They will stop at 500-fathom curve as close as possible to the position they occupied before going into port. The buoy there towed under or carried away the first night. (Clyde Buchanan now Chief Scientist on CRAWFORD.) We plan to get CHILULA to shoot a (relatively small charges compared with the one-ton shots) profile between BEAR and CRAWFORD. This has been discussed by CHILULA and CRAWFORD people ashore also and seems agreeable to the shooting group. At 1830 we heave-to to see how we will make out under operating conditions. Not bad at all. Hydrophone noise not excessive. It takes about two hours to drift down-wind past the buoy, keeping it in sight.

24 July 1962

Three shots scheduled - 0200 to 0600. Last of the three shots was a dud, and was not replaced.

Just before 0400 shot, radar showed a ship on constant bearing right through buoy position to us. They never altered course, missed buoy by about 1/4 mile, passed astern of us less than 1/2 mile. Big bulk freighter, loaded down. Ship noise on hydrophones for this shot, needless to state.

I worked on the HTL amplifiers most of the day, rebalancing and testing. We also changed bow hydrophones, replacing #022 with #348. #022 has an intermittent connection in it somewhere.

Discussion with CRAWFORD on best scheduling for the BEAR - CRAWFORD profile.

25 July 1962

Five shots, 0000 - 0500 scheduled. A combination of events resulted in four, of which last was so late in detonating (30 minutes) that neither ship got it. We have a new problem, Channel 2 (Bow) is loaded with 60-cps hum; we are trying to locate the source.

The weather has continued poor although the wind has not been much higher than 20 knots; the sea has kicked up in this time, however. CRAWFORD came alongside at about 1500, passing stores to us. Buchanan came aboard BEAR to set up our profile for CHILULA to shoot.

26 July 1962

Shots scheduled 0000 - 0600; 5 total. Weather deteriorating again, wind and seas increasing. Some good healthy rolls of 30° and better (usually just as shot is coming in).

Access (galvo camera equipment) door has parted company with the developing box, which makes it very interesting indeed to run camera, catch paper, hold door, and not get tossed across deck on rolls. In the last two shots of this set, CHILULA was in sight. We felt these shots.

CHILULA says all is set for shooting to us tomorrow. All shots will be electrically fired, the run should take about 10 hours and consists of 20 shots of 50, 100, 200, and 350 lbs. spaced to give a reversed profile between the two ships. We will start at 0800, two hours after the last of the scheduled big shots.

27 July 1962

Five shots scheduled, starting at 2330. We are surrounded by quite heavy electrical storms. The captain suggests we jettison our few

remaining caps since we do not have a cap locker aboard - we do. There is a 1/2 hour delay on the first shot due to the storm, the remainder of the shots are fired on schedule.

At 0730 we expected to see CHILULA, close aboard, and ready to start the profile. No sight, no radio contact. At 0800 they are on the air and are still at CRAWFORD buoy trying to retrieve the polypropylene anchor line; the buoy itself is aboard. They finally got 400 feet of line before it broke and then steamed for our position. Meanwhile, we have a school of tuna and some porpoises sighted. (Hooked, but could not catch, a white-tip shark just before 0600 shot).

1030: CHILULA close aboard. At 1100, after the normal amount of confused progress, the first shot of profile BEAR-CRAWFORD is fired (350 lbs). Due to delay in start we cancel our close 50 lbs. shot and take 350 lbs. as second (#3 on schedule) - excellent arrivals. No shot instants are being transmitted so we are operating on WWV as we have been for the big shots. Twenty-five to thirty-minute shot schedule. Dropped out a couple of small charges in the middle in order to get the full reverse profile and still let CHILULA leave CRAWFORD position on schedule to get into port tonight; she will be out of powder. Between 1927 and 2000 we steamed up and put a line on our buoy, thus we are actually anchored on position for the last shot at 2027.

By 2130 we have buoy aboard and crew is seeing how much of the anchor line they can retrieve. Get 1400 feet before it breaks. By 2230 we are underway for Woods Hole. Set up rotating science watches, echo-sounding plus looking for whales and porpoises.

28 July 1962

Steaming. At 1850 whale sighted ahead, blowing. Same type as sighted on outbound trip. This one about 35 feet long. Petrels around all day (Leach's, I think). Rather spectacular sunset migration of scattering layer, at least compared with what we have been seeing.

29 July 1962

At 0600 sighted school of porpoises ahead, a large school, and making great white water area. These are purposeful porpoises, since

as we came up with them they simply passed us on both sides of the ship, and continued on their way without a backward glance. Decided against chasing them, they are making knots southward. Twenty or thirty minutes later, another school sighted; we closed them at 1/3 speed. They were playing and feeding so we were able to take pictures. Shortly after resuming course we sighted whales, again apparently the same type (sperm) as previously observed. Came up with school, hove-to on silent ship; stern hydrophone (thoughtfully left all rigged for this eventuality) out and slacked. Tape recorded whale clicks and assorted other noises, and calibrated. Beautiful sea condition for this - weather clear, moderately calm sea. Shortly after getting underway again we began to see Alexander's Acres scattering on PGR, then sighted more whales. Again hove-to and made more tape recordings; also calibrated. At about 1000 we managed to flip a helix wire; while replacing it, lost Alexander's Acres and did not see it again, nor any other wildlife, except a few petrels. All navigation is celestial and DR at this point, Loran turned on once a watch and we get a fix.

At 1730, north of Hudson Canyon, more whales are sighted and a brief return of Alexander's Acres - then sunset.

30 July 1962

0700 - Noman's land just visible. 0815 - Tarpaulin Cove; E/S fish aboard, EDO secured. 0900 - coming alongside dock at Woods Hole.

TABLE I

SUMMARY OF DATA

10 July:	Depart Woods Hole. Routine echo sounding.
11 July:	E/S; deep scattering layer.
12 July:	Same as 11 July.
13 July:	0530 - start bathymetric survey; start tape recording bottom echoes; area bounded roughly by 74 - 75° W - 31 - 32° N.
14 July:	Same as 13 July.
15 July:	Finish survey. Tapes #1-26 recorded. First buoy attempt.
16 July:	Buoy anchored, 32°37.5' N, 75°12' W PGR survey of buoy area. Few test shots as CRAWFORD closes. 2200 - underway for Morehead City.
17 July:	Drift bottle stations #1-6. In port.
18 July:	1000 - underway. Drift bottle stations #7-10. E/S to buoy station.
19 July:	Seismic shots 5-9. BT #2-3. BC (BEAR-CRAWFORD reverse #1) shots 1-12 received; shots to CRAWFORD.
20 July:	Seismic shots 10-14. BT #4 Boomer run with CRAWFORD.
21 July:	Seismic shots 15-19 BT #5-10
22 July:	BT #11 E/S on station - jogging.

Table I (contd)

23 July:	BT #12-14 E/S on station
24 July:	Seismic shots 20-22 BT #15-17
25 July:	Seismic shots 26-29 (Alpha fired intervening shots to CRAWFORD) BT #18-20
26 July:	Seismic shots 30-34 BT #21
27 July:	Seismic shots 36-39 BT #22-24 BEAR-CRAWFORD shots 40-54 (reverse #2) Underway for Woods Hole - routine E/S
28 July:	Routine E/S and scattering layer observations underway. BT #25-32
29 July:	E/S and scattering layer observations. Whale music recording. BT #33-36
30 July:	Arrive Woods Hole, Massachusetts

APPENDIX

WOODS HOLE OCEANOGRAPHIC INSTITUTION
Woods Hole, Massachusetts

Technical Memorandum #2-62

Cruise Plan for BEAR #280
9 July - 31 July 1962

by

Elizabeth T. Bunce

July 1962

This work was performed under Contract
Nonr 1367(00) (NR-261-102)

CRUISE PLAN FOR BEAR CRUISE 280
9 July - 31 July, 1962

1) Scientific Party

E. T. Bunce, Chief Scientist
John Clough
James Doutt
Donald Krotser
Lewis Shapiro

2) Scientific Program:

a) A large scale crustal seismic experiment initiated by the University of Wisconsin in collaboration with Woods Hole Oceanographic Institution and a number of universities will be carried out on the continental shelf and in deep water adjacent to the North Carolina coast. The U. S. Coast Guard is providing a ship to function as the shooting ship during the experiment. A U. S. Navy demolition team will fire between 50 and 60 shots ranging in size from 500# to 3,000# at approximately 8 - 10 km intervals on a line extending seaward from Onslow Bay along a line bearing 138° T into deep water (2100 fathoms).

Purpose of the Experiment

Crustal seismic data has usually been interpreted in terms of a discretely layered earth model, each layer having a characteristic velocity of compressional elastic waves. Geophysicists have suspected for some time that this model may be too simple; velocity gradients may exist within the crust and even the transition from crust to mantle may better be represented by a velocity gradient rather than a discrete increase in velocity. Travel-time studies alone have been unable to resolve this problem to date.

The present experiment is specifically designed to eliminate some of the uncertainties normally present in the travel-time data.

Land receiving-stations using geophone spreads will be established along a 70-km extension inland from the shooting track. Two receiving positions, about 20 km apart, will be occupied by BEAR and CRAWFORD. These will be at the seaward end of the line, approximately 150 and 180 miles offshore, on the continental rise. Members of the scientific party aboard CRAWFORD will be from the Lamont Geological Observatory.

b) Enroute to and from the area we will record the deep scattering layers between the 100-fm curve and axis of the Gulf Stream, north of Cape Hatteras. A unique scattering layer (Alexander's Acres) which has been studied for some time by Dr. R. H. Backus has been observed at various seasons in this general location. Observations made at this time will contribute to this study.

c) A bathymetric survey of a section of the Outer Ridge lying between 31° to 32° N and 74° to 75° W will be undertaken before the start of the seismic program. In addition, if time intervals between the seismic shots permit it, we plan to use the Boomer to investigate the shallow geologic structure in the area of the listening position.

It will be necessary to make one port call for water and supplies. The port and date will be fitted to the schedule of the shooting ship.

3) Major Scientific Equipment:

a) Seismic Observations - Houston Technical Laboratory's seismic amplifier unit and galvanometer camera will be used to record all shots. Tape recordings will be made using Mnemotron 4-channel equipment (3 FM channels) and tape winder. Two receiving equipment units will be used, each consisting of an AX-58 hydrophone and WHOI suitcase amplifier and associated electronic equipment. Precision timing signals to be recorded are WWV time signals, a Timefax clock, and break-circuit chronometer. A Woods Hole noise generator will be used to provide calibrations for the tape recordings.

b) Bathymetric and Scattering Layer Observations - A two-channel PGR will be used for these observations. In addition, the bathymetric survey data will be continuously recorded on a Crown tape recorder.

c) Seismic Profiling - A 5000 joule Boomer will be used as the source; receiving equipment is the same as that used for the seismic work, with the PGR as recorder.

d) BT and bucket thermometer observations will be made to determine water temperature and structure.

DISTRIBUTION LIST

	No. of Copies
Bell Telephone Laboratories (Dept. 411) Whippany, New Jersey	1
Chief, Bureau of Ships Department of the Navy Washington 25, D. C.	
Attn: Code 335	1
Code 341	1
Code 631	1
Code 689B	1
Oceanographer (RU222) Bureau of Naval Weapons Department of the Navy Washington 25, D. C.	1
Director Hudson Laboratories 145 Palisade Street Dobbs Ferry, New York	1
Oceanographer U. S. Naval Oceanographic Office Washington 25, D. C.	2
Director Lamont Geological Observatory Torrey Cliff Palisades, New York	1
Systems Analysis Group Undersea Warfare Research and Development Council Room 5-224 U. S. Naval Ordnance Laboratory White Oak Silver Spring, Maryland	1

	No. of Copies
Bureau of Naval Weapons Department of the Navy Washington 25, D. C.	1
Office of Naval Research Department of the Navy Washington 25, D. C.	
Attn: Code 468	1
Code 416	1
Code 418	1
Code 466	2
Director Defense Research Laboratory University of Texas Austin, Texas	1
Commander Submarine Development Group TWO c/o Fleet Post Office New York, New York	1
Director Department of Oceanography Texas A and M College College Station, Texas	1
Director Marine Laboratory University of Miami 1 Rickenbacker Causeway Virginia Key Miami 49, Florida	1
Director Narragansett Marine Laboratory University of Rhode Island Kingston, Rhode Island	1

	No. of Copies
Librarian U. S. Naval Postgraduate School Monterey, California	1
U. S. Naval Ordnance Test Station Pasadena Annex 3202 East Foothill Boulevard Pasadena 8, California Attn: Library	1
Office of Naval Research Project Officer U. S. Navy Sofar Station APO 856 c/o Postmaster, New York	1
Office of Naval Research 495 Summer Street Boston, Massachusetts	1
Commanding Officer U. S. Navy Mine Defense Laboratory Panama City, Florida	1
Air Force Missile Test Center Technical Library, MU-135 Patrick Air Force Base, Florida	1
U. S. Navy Research Laboratory Washington, D. C.	
Attn: Code 2021	1
Code 5500	1
Code 5510	1
Commanding Officer and Director U. S. Navy Underwater Sound Laboratory Fort Trumbull New London, Connecticut	2

	No. of Copies
Commanding Officer U. S. Naval Ordnance Laboratory White Oak, Silver Spring Maryland	2
Commanding Officer and Director (Code 560) David Taylor Model Basin Washington 25, D. C.	2
Applied Physics Laboratory University of Washington 1013 East 40th Street Seattle 5, Washington	1
Commander (Code 753) U. S. Naval Ordnance Test Station China Lake, California Attn: Technical Library	1
Director U. S. Naval Air Development Center Johnsville, Pennsylvania	1
Force ASW Officer Commander, Submarine Force U. S. Pacific Fleet c/o Fleet Post Office San Francisco, California	1
Anti-Submarine Defense Force U. S. Atlantic Fleet U. S. Naval Base Norfolk 11, Virginia	1
National Academy of Sciences National Research Council 2101 Consitution Avenue Washington, D. C.	1

	No. of Copies
Commanding Officer U. S. Naval Underwater Ordnance Station Newport, Rhode Island	1
ONR Liaison Officer Woods Hole Oceanographic Institution Woods Hole, Massachusetts	1
Department of Geology University of Wisconsin Madison 6, Wisconsin	1
Daystrom Electric Division of Daystrom, Inc. 753 Main Street Poughkeepsie, New York	1
Fluid and Solid Mechanics Laboratory **Institute of Science and Technology** Post Office Box 618 Ann Arbor, Michigan	1
Ordnance Research Laboratory University Park, Pennsylvania	1
Commanding Officer and Director ASW Tactical School U. S. Atlantic Fleet Norfolk, Virginia	1
Commanding Officer and Director U. S. Navy Electronics Laboratory San Diego 52, California	2
Director Marine Physical Laboratory of the Scripps Institution of Oceanography San Diego 52, California	1
Anti-Submarine Warfare Research Center La Spezia, Italy	1

	No. of Copies
Commander Destroyer Development Group TWO c/o Fleet Post Office New York, New York	1
Commander Destroyer Flotilla THREE c/o Fleet Post Office San Francisco, California	1
Commanding Officer Anti-Submarine Defense Force U. S. Pacific Fleet Fleet Post Office San Francisco, California	1
Institute for Defense Analyses **Communications Research Division** Von Neumann Hall Princeton, New Jersey	1
Pacific Oceanographic Group Nanaimo, British Columbia	1
Armed Services Technical Information Agency Arlington Hall Station Arlington 12, Virginia	10
Chief of Naval Operations Op-07T Washington 25, D. C.	1
Chief of Naval Operations (Op03EG) Department of the Navy Washington 25, D. C.	1
Seyir ve Hidrografi Dairesi Cubuklu-Istanbul, Turkey Via: ONR Branch Office, London	1
National Institution of Oceanography Wormley, Godalming, Surrey, England Attn: Library	1

	No. of Copies
Advanced Research Projects Agencies Pentagon Washington 25, D. C. Attn: Nuclear Test Detection Office	1
Director Bureau of Commercial Fisheries Biological Laboratory Woods Hole, Massachusetts	1

Woods Hole Oceanographic Institution
Reference No. 63-10

Narrative of BEAR Cruise #280, by Elizabeth T. Bunce, 13 p. 1 fig., March 1963

Unclassified

This is a journal of BEAR Cruise 280. It contains the track chart and a summary of the data taken on the cruise. Most of the time was spent about 150 miles southeast of Cape Hatteras during a cooperative seismic refraction program which included R. V. CRAWFORD, as well as shore stations occupied by the University of Wisconsin. The scientific program of the BEAR included an echo-sounding survey, scattering layer observations, and seismic refraction studies.

1. Seismic Refraction
2. Bathymetry
3. Scattering layer
4. Inshore Drift Bottles

1. Bunce, Elizabeth T.

This card is UNCLASSIFIED

Woods Hole Oceanographic Institution
Reference No. 63-10

Narrative of BEAR Cruise #280, by Elizabeth T. Bunce, 13 p. 1 fig., March 1963.

Unclassified

This is a journal of BEAR Cruise 280. It contains the track chart and a summary of the data taken on the cruise. Most of the time was spent about 150 miles southeast of Cape Hatteras during a cooperative seismic refraction program which included R. V. CRAWFORD, as well as shore stations occupied by the University of Wisconsin. The scientific program of the BEAR included an echo-sounding survey, scattering layer observations, and seismic refraction studies.

1. Seismic Refraction
2. Bathymetry
3. Scattering layer
4. Inshore Drift Bottles

1. Bunce, Elizabeth T.

This card is UNCLASSIFIED

Woods Hole Oceanographic Institution
Reference No. 63-10

Narrative of BEAR Cruise #280, by Elizabeth T. Bunce, 13 p. 1 fig., March 1963.

Unclassified

This is a journal of BEAR Cruise 280. It contains the track chart and a summary of the data taken on the cruise. Most of the time was spent about 150 miles southeast of Cape Hatteras during a cooperative seismic refraction program which included R. V. CRAWFORD, as well as shore stations occupied by the University of Wisconsin. The scientific program of the BEAR included an echo-sounding survey, scattering layer observations, and seismic refraction studies.

1. Seismic Refraction
2. Bathymetry
3. Scattering layer
4. Inshore Drift Bottles

1. Bunce, Elizabeth T.

This card is UNCLASSIFIED

Woods Hole Oceanographic Institution
Reference No. 63-10

Narrative of BEAR Cruise #280, by Elizabeth T. Bunce, 13 p. 1 fig., March 1963.

Unclassified

This is a journal of BEAR Cruise 280. It contains the track chart and a summary of the data taken on the cruise. Most of the time was spent about 150 miles southeast of Cape Hatteras during a cooperative seismic refraction program which included R. V. CRAWFORD, as well as shore stations occupied by the University of Wisconsin. The scientific program of the BEAR included an echo-sounding survey, scattering layer observations, and seismic refraction studies.

1. Seismic Refraction
2. Bathymetry
3. Scattering layer
4. Inshore Drift Bottles

1. Bunce, Elizabeth T.

This card is UNCLASSIFIED